SMALL CARNIVORE CONSERVATION

The Newsletter and Journal of the IUCN/SSC Mustelid, Viverrid & Procyonid Specialist Group

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Large-spotted civet (*Viverra megaspila*). Photo by R. Wirth.

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We are particularly grateful to Walter Rasmussen for reading the manuscripts and improving the English style.

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The aim of this publication is to offer the members of the IUCN/SSC MV&PSG, and those who are concerned with mustelids, viverrids, and procyonids, brief papers, news items, abstracts, and titles of recent literature. All readers are invited to send material to:

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Field observations of Large-spotted civet *Viverra megaspila* in Laos with notes on the identification of the species

J. W. DUCKWORTH

Introduction

The genus *Viverra* includes four Asian species: Malay civet *V. tangalunga*, Large Indian civet *V. zibetha*, Malabar civet *V. civettina*, and Large-spotted civet *V. megaspila*. The African civet *V. civetta* is now usually placed in the monotypic genus *Civettictis*. The forests of Madagascar support a species rather similar in appearance, Madagascar civet *Fossa fossana*, but this is not closely related to the *Viverra* group.

V. tangalunga and *V. zibetha* are widespread species, common and ecologically tolerant throughout their ranges (the southern part of the Malay Peninsula, the Greater Sundas and the Philippines, and eastern India, Nepal, Burma, southern China, Indochina and the Malay Peninsula respectively). *V. megaspila* and *V. civettina* are closely related and frequently considered conspecific (as *V. megaspila*; Lekagul & McNeely, 1977), and were formerly placed in their own genus (*Moschothera*). Their distributions are widely disjunct, and in contrast to the other two species, they are scarce and little known. *V. civettina* is restricted to southwest India (the Western Ghats and Travancore) and is acutely threatened (Rai & Kumar, 1993). *V. megaspila* has a more extensive range encompassing Burma, Thailand, Vietnam, and Malaysia (Wilson & Reeder, 1993); it is also mapped in Cambodia and Laos by Lekagul & McNeely (1977) and Corbet & Hill (1992).

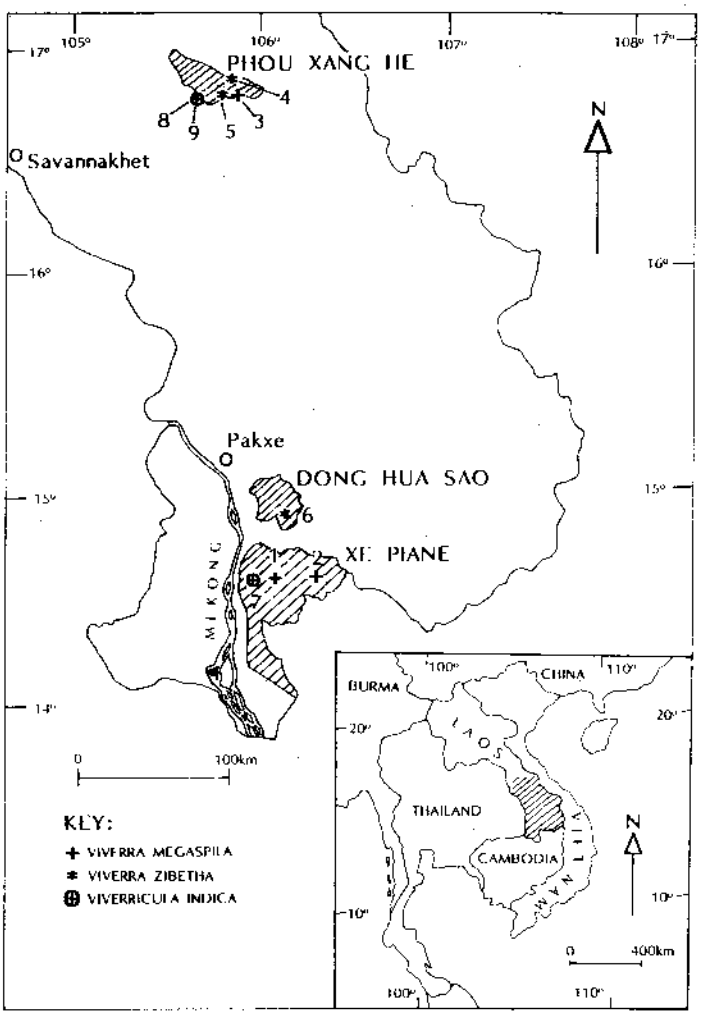
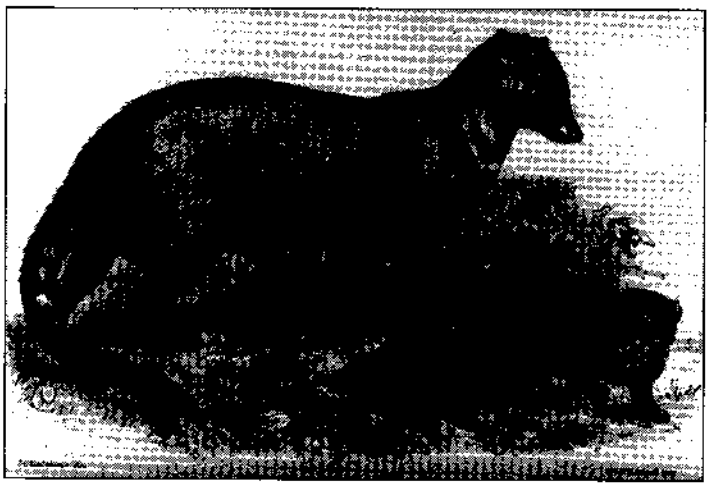


Fig. 1. Map of southern Laos, showing localities of civet sightings, numbered as in Table 1. Thick lines enclose the proposed protected areas surveyed. Inset shows region of Laos depicted.



Oldest figure of a Large-spotted civet. From: A. Günther. 1876. Proc. Zool. Soc. London

The large-spotted civet is so infrequently seen that Lekagul & McNeely (1977) could trace nothing concerning the species' ecology or behaviour, even though they considered it rather common. This status was contested in Schreiber *et al.* (1989), who further stated that although widespread in peninsular Malaysia, it was also rare there. Overall, they categorised it as occurring in very low numbers and to be considered as threatened. They traced no records from protected areas. Although recorded from Huai Kha Khaeng Wildlife Sanctuary, Thailand, by Rabinowitz & Walker (1991), this was based on reports by staff; the species was not observed during intensive carnivore orientated fieldwork there. In a summation process judging each species' conservation priority, it received 8 of a possible 16 points; the most important action was the initiation of field studies of the species as so little is known about it (Schreiber *et al.*, 1989).

Laos is biologically very poorly known and, between 1950 and 1992, almost no reliable information was gathered concerning the status of small carnivores in the country. I attempted to survey nocturnal mammals at three sites in the southern provinces between October 1992 and July 1993 (Fig. 1), as part of a team surveying the birds and mammals of proposed protected areas (PPAs) in Laos. The natural vegetation cover across this area is semi-evergreen forest with extensive areas of mixed deciduous forest and, on the poorest soils, dry dipterocarp forest. Large areas of forest have been degraded by human activity or cleared outright for settlement and cultivation.

In general, fieldwork was hampered by the heavy hunting pressure (including the use of lamps by night) and the scarcity of wide paths traversing productive habitat. The main technique (detailed in Duckworth, 1992) was to walk slowly (about 0.5-1.6 km/h) using a headtorch to search for eyeshines and body shapes of animals, and to listen for vocalisations and the rustlings of disturbed vegetation; animals were illuminated with a halogen spotlamp (Nitech X-Cell; 100.000 candlepower). Only in one

area this was particularly productive: at Phou Xang He, there were several areas of relict primary forest along roads, possibly remaining because of the high density of undetonated landmines thereabouts. Because of the low success of this technique, and following the advice of numerous hunters, many nights were spent up trees overlooking hotspots such as waterholes, saltlicks, and fruiting trees. Such watches were performed mainly on moonlit nights. In a rough total of 215 hours walking and 29 nights up trees, six *Viverra* civets were recorded (Table 1). The three records of *Viverricula indica* have also been included, as this is the only possible confusion species.

Field identification

Civets of the two genera are easily distinguished from all other mammals of the region by their terrestrial habits, general shape, banded tails and by their black and white throat markings. It is easy to distinguish *Viverricula* from *Viverra*: compared with the latter, *Viverricula* is leaner and more slender (in some ways reminiscent of a genet (*Genetta*), with a very bushy, horizontal tail, shorter legs and a narrower, more "streamlined" head. Obvious differences in pelage include the lack of a dorsal crest and (of particular use in the field) the much less prominent throat markings of *Viverricula*.

The two species of *Viverra* are also easily separated, provided a reasonably close view is obtained. However, the existing literature does not stress the differences of most use in the field, so I therefore visited the skin collection at The Natural History Museum, London, to supplement my field experience (which includes all species discussed here except *V. civettina*). Skins were examined of 38 *V. zibetha* and 12 *V. megaspila*; the latter were from throughout the species' range.

Viverra civets are the most dog-like of the Viverridae, with long legs and rather canine heads and muzzles. All share a rather rolling walk which combines with their often almost pregnant-looking hindquarters to give a very distinctive mien. The two species in Indochina are similar in size and structure and, in the field, the observer should concentrate on pelage features. Both share a bold black and white marking arrangement on the foreneck and upper chest, a thick black erectile dorsal crest, a dark and light banded tail, and a pattern of dark spots, blotches or bars on a light body. The tail and body patterns are the most important features for separating the two species (Table 2).

Accurate observation of the tail pattern is the highest identification priority at each sighting, followed by the body pattern, especially on the flanks. Contrary to the impression given by some previous works, in South-east Asia north of the isthmus of Kra, any *Viverra* with bold dark markings on the upperparts is probably *megaspila*, be they spots or bars. The illustration of *V. civettina* in Rai & Kumar (1993) gives a good impression of a *V. megaspila* where the spots have merged into heavy horizontal bars.

Habitat and behaviour

All individual large-spotted civets were on the floor when found and none was obviously disconcerted by illumination. Individual 1 was observed under natural light at dusk beside a stream. It came within 7 m of the observer and remained in the area for three minutes while it trotted across the sandy bed of a drying river and into a riverside bamboo thicket. Individual 2 was picked up as a moonlit shape walking beside a pool at 50 m range. After initial identification to genus, I illuminated it with the Nitech spotlamp; it continued to amble slowly along a buffalo-path through the burnt grass layer, until after several minutes it left the glade and disappeared into the forest. Individual 3 was located by rustling sounds in thick bamboo beside a well-established road; I walked parallel to it for 7 m, separated by about 15 m, before it emerged onto the road for 30 seconds at 10 m range. It re-entered the bamboo grove and resumed foraging.

The three single *V. zibetha* seen were all located by eyeshine and were seen on open paths or roads within 20 m of the observer and then ambled back into the vegetation, where they resumed foraging.

From the sounds made by those at Phou Xang He, it seems that the two species forage in similar fashion to the African civet: by a slow walk accompanied by much side-to-side casting of the head as the animal searches through leaf-litter. Such rustlings were rather frequently heard at Phou Xang He, though the prevalence of undetonated mines prevented my leaving the path to identify the culprit(s). Pigs *Sus* and porcupines *Hystrix* also make similar noises, but some of the foraging noises were accompanied by decidedly carnivorine whickering calls, suggesting that civets were common in the area.

Status and conservation

The foregoing sightings are too few to allow a firm assessment of the species' status. Only at Phou Xang He there were roads running through good habitat, and here 116 hours' walks were done. In this time there was only one sighting of *V. megaspila*. However, despite their productivity for arboreal mammals (Duckworth, in press), the roads were not conductive to

	Ref	site	date	time	co-ordinates	alt.	habitat
Viverra megaspila	1	XP	13 Feb	18h45	14°35'N, 106°02'E	200	good semi-evergreen forest
	2	XP	6 Mar	23h15	14°31'N, 106°21'E	80	good dry dipterocarp forest
	3	PXH	28 Mar	22h00	16°45'N, 105°53'E	200	degraded semi-evergreen forest
Viverra zibertha	4	PXH	13 Apr	19h15	16°40'N, 106°01'E	200	deg. mixed deciduous forest
	5	PXH	18 Apr	03h50	16°47'N, 105°53'E	200	degraded semi-evergreen forest
	6	DHS	19 Jun	00h45	15°00'N, 106°13'E	1100	good montane evergreen forest
Viverricula indica	7	XP	11 Feb	00h25	14°36'N, 105°57'E	400	good semi-evergreen forest
	8	PXH	18 Apr	20h10	16°42'N, 105°40'E	200	deg. mixed deciduous forest
	9	PXH	18 Apr	25h45	16°42'N, 105°40'E	200	mixed decid.-dry dipt. ecotone

Notes: there was very little nocturnal searching in DHS, and only in PXH were particularly suitable tracks found for walking. The ref refers to the number on Fig. 1; altitude (alt.) are in meters. Sites: XP, Xe Piane; PXH, Phou Xang He; DHS, Dong Hua Sao.

Table 1: records of *Viverra* and *Viverricula* civets in Laos, 1993.

Table 2: pelage features for distinguishing *V. megaspila* from *V. zibetha*

	V. megaspila	*V. zibetha*	
FLANKS	Boldly marked with black or very brown, usually as lines of spots but frequently the spots towards the rear of the upper lines run together to give one to three bars either side of the dorsal crest.	Rather hazily marked dark, as irregular wavy spots sometimes running together as horizontal bars. General appearance rather grizzled or rippled and especially nebulous-looking under torchlight.	FLANKS
TAIL	Dark dorsal stripe along entire length; pale rings thus broken at top and anyway rather sullied-looking. Distal half frequently appears entirely dusky.	No dark dorsal stripe, thus pale rings complete. These rings are very prominent aloing the length of the tail, as they are almost white and clear cut. They are still much narrower than the dark rings though.	TAIL

sighting terrestrial mammals, because of the thick growth of ruderals along their margins: the only other carnivore seen on the ground was a single Leopard cat *Prionailurus bengalensis*, and, though Muntjacs *Muntiacus muntjac* were frequently heard, none was seen. Sightings were essentially due to chance and it is unlikely that *V. megaspila* was unusual at the site. The small number of records is surprising, given that when observed, the species appeared unperturbed by torchlight. Considering the broad habitat choice (Table 1), it is likely that the species is neither critically threatened nor particularly localised in Laos. Further information is needed on the altitudinal range of the species.

The two sites where *V. megaspila* was observed all supported impressive complements of globally-threatened species, including the Gibbon *Hylobates (concolor) gabriellae* (Duckworth *et al.*, in prep.), Pygmy loris *Nycticebus pygmaeus* (Duckworth, in press), Douc langurs *Pygathrix nemaeus* (Timmins, in prep.), Asian elephants *Elephas indicus*, wild cattle and numerous birds (Evans *et al.*, in prep.; Thewlis *et al.*, in prep.). There is thus an acute need for effective conservation of the areas. The specific requirements of this civet are likely to rest primarily upon the preservation of adequate areas of forest coupled with fairly low hunting levels. It should be noted that at all sites shots were frequently heard by day and night, and that in the area of Phou Xang He where the *Viverra* civets were encountered, hunting had extirpated all diurnal primates. In some other areas, collection of the secretions from the perineal glands (known as "civet") poses a potential threat, but no evidence of this activity was found during these surveys (there were fairly extensive general and discursive chats with villagers about their knowledge of forest wildlife).

Laos is of particular importance for conservation of south-east Asian mammals because of its extensive remaining tracts of forests: although almost all the area is hunted to some extent, over large regions the basic fabric of the habitat is still fundamentally undegraded. This contrasts markedly with the situation in neighbouring Thailand and Vietnam.

Acknowledgements

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Ecology of the Central American Cacomistle, *Bassariscus sumichrasti, in Costa Rica*

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Introduction

Central America covers 541,190 km^2 and includes seven countries between subtropical Mexico and Columbia (Guatemala, Belice, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama) (Vaughan, 1994). It is one of the most diverse cultural and biological regions worldwide (Leonard, 1986; Vaughan 1990, 1993), but also has one of the most rapidly expanding human populations. This human population is currently altering natural habitats at an unprecedented rate, affecting many wildlife species (Carrillo & Vaughan, 1994; World Resources Institute, 1994).

The status of the Procyonidae family is virtually unknown in Central America. The six procyonid species reported there include: Common raccoon (*Procyon lotor*), Crab-eating raccoon (*P. cancrivorous*), White-nosed coati (*Nasua narica*), Bushy-tailed olingo (*Bassaricyon gabii*), Kinkajou (*Potos flavus*), and the Cacomistle (*Bassariscus sumichrasti*) (Hall, 1981; Wilson, 1981; Novak & Paradiso, 1983; Emmons, 1990). Until five years ago, no scientific studies had been conducted on these species in Central America.

In 1989, professors and graduate students of the Regional Wildlife Management Program for Mesoamerica and the Caribbean (*) at the Universidad Nacional in Costa Rica began basic natural history research on both *Procyon* species found in Costa Rica (Carrillo, 1989, 1990; Carrillo & Vaughan, 1988, 1993), and the white-nosed coati (Vaughan & Saénz, 1993; Saénz, 1994). Our intention is to study the procyonid species found in Central America over the next decade, providing a solid data base for their conservation.

We are especially interested in understanding their role as seed dispersers and tropical tree reforesters, thus giving them economic value for their long-term conservation (Howe & Smallwood, 1982; Estrada & Fleming, 1986; Howe & Westley, 1988; Levey *et al.*, 1992). Graduate students from different Latin American countries have also begun studies of mustelids, including the Grison (*Gallictis vittata*) (Malavassi, 1991) and the River otter (*Lutra longicaudis*) (Spinola, 1994; Spinola & Vaughan, two articles in press).

Although the common and crab-eating raccoons, the white-nosed coati, and the kinkajou are observed in a wide variety of Central American environments and coexist with man (barring intensive land use and overhunting), the olingos and cacomistle are considered uncommon and secretive (Novak & Paradiso, 1983; Kaufmann, 1987; Emmons, 1990). Even mammal surveys and collections in countries such as Costa Rica where a lot of research is carried out rarely reveal these species (Goodwin, 1946; Vaughan, 1983; Timm *et al.*, 1989).

In February 1994, we began a study of a cacomistle population at 2,600 m elevation in Braulio Carrillo National Park, Costa Rica. The remainder of this report will discuss the cacomistle project and its dry season results (Feb. - May 1994). The project is scheduled for 24 months total, and an Argentinian graduate student will begin her M.S. thesis work on the population in December 1994. The objectives of these research projects were: a) to study their ecology (home range, activity patterns, distances moved per night, sleeping site locations, and diet) and b) to determine the cocomistle's role as a seed disperser and reforester in cloud forests.

Study site and study species

Braulio Carrillo Natl. Park forms part of the Cordillera Volcanic Central Conservation Area (CVCCA)(135,500 ha) in central Costa Rica (Vaughan, 1994)(Fig. 1). Considered one of Costa Rica's most rugged wilderness regions (Boza, 1992), the CVCCA is found between 100 and 3,200 m ASL, and includes the well-known La Selva Biological Station at its lowest elevation (Clark, 1994) and two active volcanoes (Poàs and Irazu) at its higher elevations. It receives an estimated annual 4,500 mm of precipitation (Boza, 1992) and provides habitat to an estimated 6,000 plant species, 347 bird species, and 142 mammal species (Timm *et al.*, 1989).

The research site is based at the Barva guard station (Fig. 1) located 2 km north and 0.5 km east of the town of Sacramento (Timm *et al.*, 1989). It is on the pacific side of Volcan Barva at 10°07'N, 84°074W. The habitats surrounding the study site include: pasture, primary and secondary cloud forests, dominated by tree species of the Lauraceae and Fagaceae families.

The cacomistle is a nocturnal arboreal member of the procyonid family, ranging from southern Mexico to western Panama up to 2,000m ASL (Emmons, 1990) or 2,8000 m (Kaufmann, 1987). Little is known about its natural history, although its conspecific, the ring-tailed cat (*Bassriscus astutus*), found between southern Oregon in the United States to Oaxaca and Veracruz in Mexico (Kaufmann, 1987) has been studied in the southwestern United States (Toweill & Teer, 1977, 1980; Brody & Koch, 1983; Yarchin, 1990).

Radio	Sex	Date (1994)	Tag Color	Body (cm)	Tail (cm)	Total (cm)	Tarsal (cm)	Nexk (cm)	Weight (kg)	
005	F	14Feb	Black	44	45	89	8.5	13	1.45	
019	F	3March	Red	41	49	90	11		1.30	
029	M	5March	White	37	41	78	10	14	1.00	
041	M	5March	Green	39	46	84	11	11.5	1.10	
181	M	3March	Yellow	45	50	95	12		1.55	

Table 1: Capture data on Cacomistle (*Bassariscus sumichrasti*) in Braulio Carillo National Park, Costa Rica (February-March, 1994)

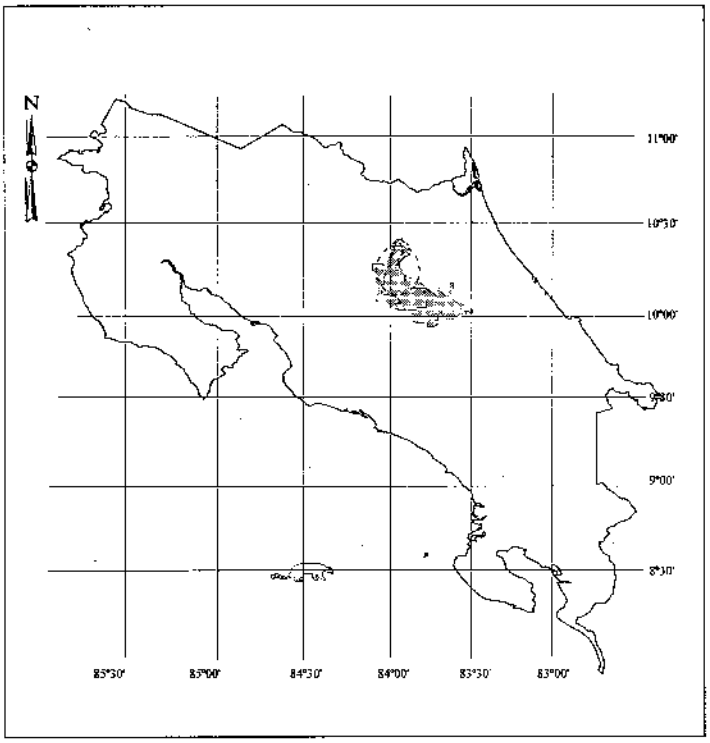

Fig. 1. Study site in Costa Rica

Methodology

- **Capture** - Cacomistles were preconditioned to enter live Havahart traps baited with brown sugar blocks over a 28-day period during February 1994. Five cacomistles were live-capured, and drugged with ketamine hydrochloride (11 mg/kg) and xylazine (1.5 mg/kg). Then each cacomistle was weighed, measured, and a MD-200 radiotransmitter (Telonics Electronics Inc., Mesa, AZ) with distinct tape color code placed around its neck. The procedure took between 15 and 20 minutes and the individual was left hanging in a gunny sack and released after recovering (usually 60-90 min).

- **Radiotelemetry** - Radiotelemetry data were taken with a LA12 receiver and H antenna (Telonics Electronics Inc., Mesa, AZ) from two predetermined tracking sites along the main trail connecting the Barva guard station with Laguna Barva. After determining that the cacomistle was a nocturnal species, individuals were tracked at 30-minute intervals for 12 hours, usually on consecutive two-night periods (18:00-24:00 and 24:00-06:00). For each frequency, the antenna was directed towards the strongest radio-pulse and a compass bearing was taken from each of two stations. A 45-90 degree angle between the stations was sought for telemetry analysis. Using the Telem 88 computer program, the compass bearings obtained and the (x,y) coordinate of each radiotelemetry station calculated from an aerial photograph, data were triangulated to determine cacomistle home range, movement and activity, and sleeping sites.

- **Home rage** was determined by including 100% and 95% of the triangulated locations in the minimum convex polygon method (Southwood, 1962). For the 95% home range, 5% of the points farthest from the harmonic mean were eliminated.

- **Movement or distance moved** was calculated in meters between consecutive points and average total distance moved per night was determined. Chi squared tests were used to analyze movement in 6-hour periods.

- **Activity level** was recorded at the beginning of each 30-minute reading depending on the strength, length, and pattern of the radio-pulse. Individuals were noted as active (A) if the pulse was changing in strength and length and non-active (NA) if it was constant in duration. For analysis of activity levels, data were grouped into six 2-hour intervals and one interval for the 06:00 time period. Total active and non-active nightly readings were combined for each cacomistle. Replicated G tests (Biom: Goodfit) comparing active to non-active were carried out. The G value was analyzed using the Chi-squared test to determine statistical significance.

- **Sleeping sites** were recorded by triangulating between 10:00-15:00 hours from the trail system and then plotting it on a map. Trees were scanned with binoculars and by using the radiotelemetry receiver without the antenna and cable and with only the cable to determine exact location.

Results and discussion

- **Capture and radiotelemetry data** -Information on radiotelemetry data and animal measurements is shown in Table 1. The study group consisted of two adult females (#5 and #19), one adult male (#181), and two juvenile males (#41 and #29). However, adult male #181 wasn't radiotracked because he frequently moved out of tracking range. Juvenile males were classified as such because of their milk teeth, undescended testicles, and weight. Toweill & Toweill (1978) and Yarchin (1990) reported that with *B. astutus*, growth is so rapid that after three months of age, it is difficult to distinguish kittens from adults. A total of 753 radiotelemetry points were taken on the four individuals between March-May 1994, representing approximately 20 full nights of data on each individual.

- **Home range** -The 95% home ranges for males #41 and #29 were 22.5 ha and 16.5 ha, respectively, while the 95% home ranges for females #5 and #19 were 25.6 and 32.7 ha respectively (Fig. 2). The home ranges of two females didn't overlap, nor did the home ranges of the two males. However, the home ranges of #41 and #19 overlapped, as did those of #29 and #5. Yarchin (1990) found an average home range of 20 ha for four individuals of *B. astutus* in Zion National Park, Utah, USA. Brody & Koch (1983) reported home ranges of 49-233 ha for four males during four months in California, while Trapp (1978) found similar-size ranges in Zion. Toweill & Teer (1980) found two males with home ranges of 35 and 51.7 ha and three females with home ranges of 15.7-27.7 ha in Texas. In all of the above studies (and ours), neither males or females had overlapping home ranges with other individuals of their sex.

Individual and combined sexes	$\bar{X}$-distance moved 1800-0600
F(5)	2,549 m
F(19)	2,833 m
M(29)	2,502 m
M(41)	2,637 m
(F) average	2,691 m
(M) average	2,569 m
(Total) average	2,630 m

Table 2. Average distance moved (18:00-06:00) for each individual, sex and total population of Cacomistles (*Bassariscus sumichrasti*) in Braulio Carrillo National Park, Costa Rica (Feb.-March 1994).

- **Movement** - Average distance travelled nightly for each individual is shown in table 2. Female #19 moved the greatest distance (2, 833 m), while male #29 moved the least (2,502 m). Average distances moved by the two females wasn't significantly greater than the distance moved by two males.

- **Activity patterns** - *B. astutus* is basically nocturnal and in 100 daytime sleeping site locations taken between 10:00-15:00, only once did we find a cacomistle active during daytime. Occasionally, we would find a study animal active during the late afternoon (17:00 h). Ringtails are rarely active in the daytime (Trapp, 1978; Toweill & Teer, 1980; Kaufmann, 1987; Poglayen-Neuwall & Toweill, 1988). Nightly activity compared in two hour intervals is shown in Table 3. Cacomistles were most active from 18:00-20:00. The results of the replicated G tests indicate that cacomistles were more active than inactive in all time period from 18:00-06:00. They were four times more active than inactive from 20:00-22:00, 22:00-24:00, 24:00-02:00, and 04:00-06:00. We found juvenile males active in close proximity to the adult females, which differs from Yarchin's (1990) results where his four study animals avoided each other.

- **Sleeping sites** were located over 70 occasions and differed most days. Exact den location wasn't determined, but they were high in trees, usually *Quercus* sp. Prior research on *B. astutus* determined that they locate dens for reproduction in caves, rock crevices, burrows dug by other animals, brush piles, hollow trunks, roots and limbs (Trapp, 1978; Toweill & Teer, 1980; Yarchin, 1990). Female #19 and male #41 slept in the same general area. Female #5 and male #29 slept in the same general area about 50% of the time. In 935 separate locations of ringtail den sites with radiotelemetry, no more than one adult was observed per den (Yarchin, 1990).

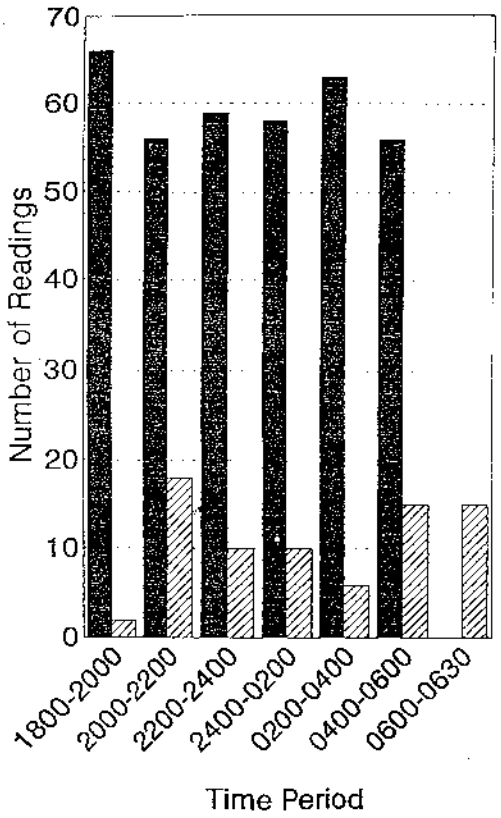

Table 3. Activity level (18:00-06:00) for Cacomistle (*Bassariscus sumichrasti*) population in Braulio Carrillo National park, Costa Rica (Feb.-March 1994).
[Dark = active; light = not active]

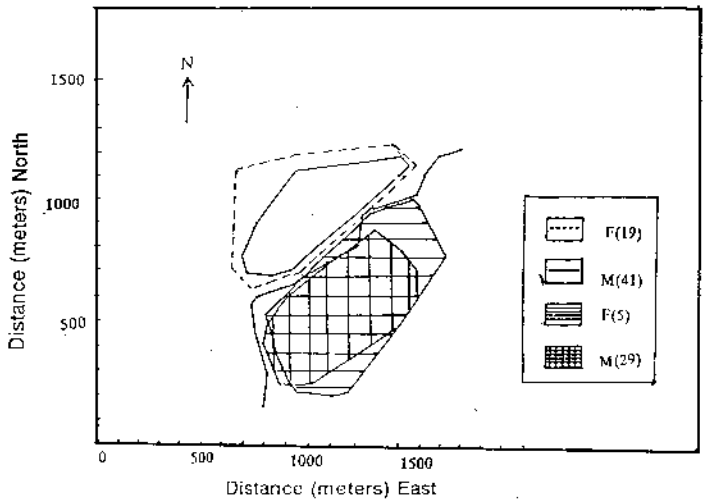

Fig. 2. Home range of four Cacomistle (*Bassariscus sumichrasti*) in Braulio Carrillo National Park, Costa Rica (Feb.-March 1994.

Future research

For management and conservation efforts, we are accumulating a 24-month data base on the cacomistle. Sleeping sites are difficult to determine and we will climb trees which often are 40 m high. Due to their irregular calling periods after midnight, we estimate that the population in the region may be 12-15 individuals. We are especially interested in determining the cacomistle's role as a seed disperser and reforester. However, the only collected faeces thus far were from trapped animals. To collect faeces, we plan to wait for individuals when they become active at sunset and place plastic sheets under sleeping trees. Over the study period, we will work with these aspects, collecting data from both wet and dry seasons, mapping out vegetation type use and strengthening our data base. We are surprised at the lack of fear these intelligent procyonids have of human beings. After release, a large male unassumedly jumped into a garbage can and picked up a cantelope rind, making off with it before some surprised observers. We were reminded of raccoon and coati behavior.

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*) PRMVS was created in 1987 as the first wildlife-biological conservation graduate program in Latin America. To data, 65 graduate students from 16 Latin American countries and the USA have studied there.

Regional Wildlife Program for Mesoamerica and the Carribean, Universidad Nacional, Heredia, Costa Rica and Associated Colleges of the Midwest, San Pedro de Montes de Oca, Costa Rica

Canine distemper epidemic in Serengeti lions

An epidemic of canine distemper virus (CDV) has affected approximately 20-30% of the population of 3,000 African lions (*Panthera leo*) in the Serengeti ecosystem of Tanzania according to Dr Melody Roelke-Parker (Tanzania National Park Service and Messerli Foundation, Switzerland) and Dr Craig Packer (University of Minnesota, USA). Documented losses in closely-observed prides from long-term behavioral studies varied from entire prides to a few lions in a pride. More than 50 lions from these research prides have died or disappeared since early February 1994. The first notable clinical signs were myoclonus (predominantly facial and foreleg twitches), ataxia, and seizures. Some lions had nasal and ocular discharge or non-specific signs of systematic disease. More than half of all lions with clinical signs died or vanished. Necropsy findings in eight lions were not remarkable and were predominantly associated with trauma and dehydration.

Characteristic histopathologic lesions of CDV were not noted in most cases (A. Pospischil, University of Zurich, Switzerland). However, typical CDV inclusions were noted in bile duct and epididymal epithelium (L. Munson, University of Tennessee, USA), and these inclusions were confirmed to be canine distemper viral particles by Immunohistochemistry (M. Appel, Cornell University, USA).

Canine distemper viral antigens also were identified by immunohistochemistry in other fixed tissues (A. Pospischil). Forty-five of 60 lions tested in the region had high serum neutralizing antibodies to canine distemper virus (M. Appel), indicating that exposure was widespread in the population. **Other carnivores in the ecosystem also have been reported to be affected**. The full impact of this epidemic on the ecosystem has yet to be determined.

Until recently, canine distemper virus only rarely infected individual felids in zoos. Since 1992, however, there have been four epizootics of canine distemper virus affecting predominantly African and Asian felids in US zoos. The extent of the morbidity and mortality in these recent outbreaks, including the current epidemic in the Serengeti suggest that CDV has acquired increased pathogenicity for felids. There was no evidence of co-infection with other pathogens, and no link with feline immunodeficiency virus (FIV) exposure in the Serengeti lions (S.J. O'Brien, National Cancer Institute, USA).

Controlling the Serengeti epidemic through vaccination of wildlife is neither safe nor feasible, because currently available modified-live CDV vaccines can induce disease in carnivores other than domestic dogs. Current recommendations to contain the epidemic are to vaccinate domestic dogs in the perimeter of and within the serengeti, and to continue disease surveillance of susceptible species at the site. The SSC Veterinary Group would appreciate receiving information on any sightings of tremors, seizures, or unexplained deaths in **wild cats or other carnivores in any country.**

Contact Dr Michael Woodford (Washington, D.C., USA; Fax 202-331-9448) or Dr Linda Munson (Knoxville, TN, USA; Fax 615-974-5616). We can provide a list of samples to collect for diagnostic procedures as well as pathology, serology, and virology services for field veterinarians and wildlife ecologists, if tissue or serum samples are available from a suspected epidemic.

Linda Munson, Dept. of pathology, Univ. of Tennessee CVM, 2407 River Dr., Knoxville, TN 37996, USA

The European polecat (*Mustela putorius*) in Turkish Thrace

Cengiz KURTONUR[1], Boris KRYŠTUFEK[2] and Beytullah ÖZKAN[1]

Introduction

The European polecat, *Mustela putorius* Linnaeus, 1758, is very poorly known in the southern half of the Balkans; there being only two records from Greece (Crucitti & Tringalli, 1984; Wolsan, 1993). Kryštufek & Petkovski (1990) concluded, on the basis of six localities, that the species is quite widespread within Macedonia, and Markov (1959) reports it from Bulgaria, inhabiting forest edges, the vicinities of villages, and the banks of rivers. Despite this, the majority of authors have not mentioned its presence in European Turkey (e.g. Van den Brink, 1968; Gepther & Naumov, 1967; Corbet, 1978; Görner & Hackethal, 1987; Corbet & Harris, 1991, etc.), although there are some published records from this country, albeit of a very fragmentary nature. Kumerloeve (1967, 1970, 1975) reports three localities (summarized by Wolsan, 1993), and Dogramaci (1989) mentions the Belgrade Forest near Istanbul as representing a further polecat locality.

Results and discussion

Recently we had the opportunity to examine five polecats (four skulls and five skins) from European Turkey. The specimens are stored in the collections of the Department of Biology, University of Trakya, Edirne (TUBD) and the Slovene Museum of Natural History, Ljubljana (PMS). All the skins are dark, and could be ascribed without any doubt to *Mustela putorius*, rather than to *M. eversmanni*. However, one of the skulls (TUBD 87/100) had very narrow postorbital constriction (Fig. 1), in this respect resembling the Steppe polecat, *M. eversmanni*. In this specimen the ratio of the postorbital constriction with the condylobasal length as the denominator and multiplied by 100, amounted to 22.9, thus being within the range reported for *M. eversmanni* (20.1-24.9; Miric, 1976). As a result, we subjected our material to Discriminant Function Analysis (DFA). Seven skulls of *M. putorius* from Slovenia (PMS) and the former Czechoslovakia (National Museum, Prague) served as standards for these two species. Because of the significant sexual dimorphism present in polecats (Buchalczyk & Ruprecht, 1977), only males were used in DFA. Three specimens from European Turkey were compared with this reference material. Two of them (TUBD 91/320 and 92/170) were considered to belong to *M. putorius*, whilst the identity of specimen TUBD 87/100 was uncertain. Two measurements (IC, RB; see table 1) were excluded to increase the Turkish sample size.

TUBD No.	87/100	91/320	92/170	93/121
Sex	*male*	*male*	*male*	*female*
W	800	1,100	----	----
HB	555	400	470	410
TL	145	125	160	135
HF	60	60	61	60
E	25	27	26	26
CbL	65.0	65.6	67.2	59.0
PL	66.0	66.0	68.2	59.3
ZyB	42.2	42.3	44.1	34.4
EctB	22.9	23.9	26.7	19.8
IC	18.2	18.5	---	15.5
PB	14.9	16.3	18.4	14.3
MB	37.3	36.3	38.4	32.8
MxTRL	19.4	19.3	20.4	18.2
RB	17.7	17.2	---	14.1
BcH	25.0	25.8	25.2	22.4
MdL	42.5	41.4	42.8	35.1
HRM	20.6	20.7	21.4	16.2
BL	43.5	44.6	40.7	---

Table 1. Morphometric characteristics of polecats from European Turkey: W, weight; HB, head and body length; TL, tail length; HF, hind foot length; E, ear length; CbL, condylobasal length; PL, profile length; ZyB, zygomatic breadth; EctB, ectoorbital breadth; IC, interorbital constriction; PB, postorbital constriction; MxTRL, maxillary tooth-row length; RB, rostrum breadth on C^1-C^1; BcH, braincase height per bullae; MdL, mandible length; HRM, height of ramus mandibulae; BL, length of baculum. For definitions of skull parameters see Buchalczyk & Ruprecht (1977). All dimensions are in mm, weights in grams

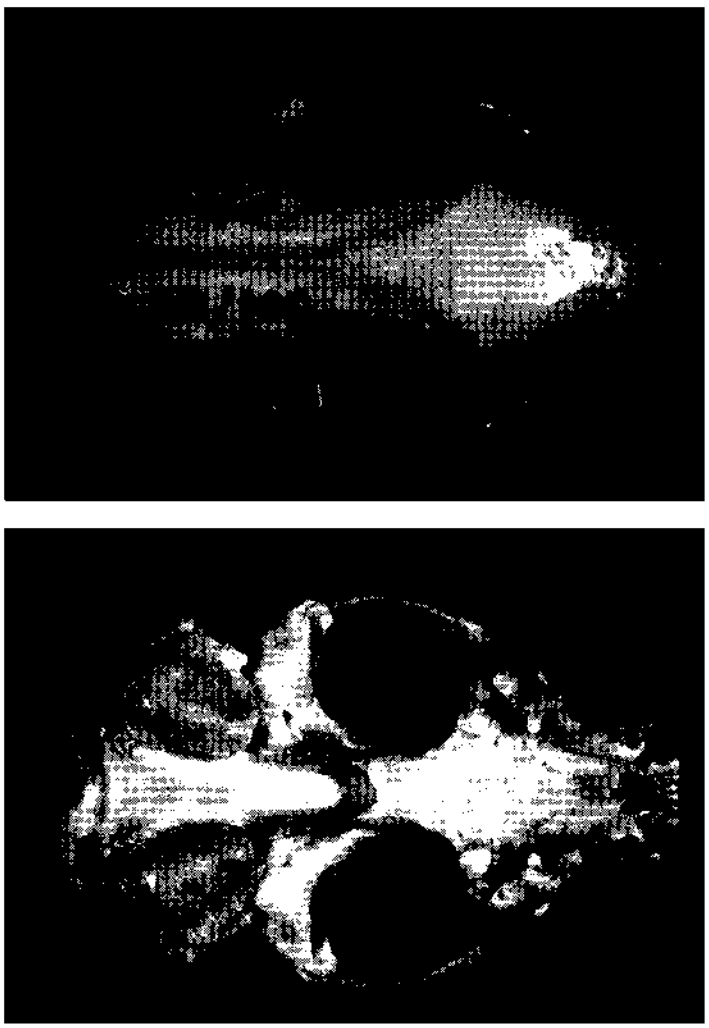

Fig. 1. Skull of the male European polecat from Edirne, European Turkey (87/100) in a (a) dorsal and (b) ventral view. Note narrow postorbital constriction (a) and shape of interpterygoid fossa and pterygoid processes (b)

The first discriminant function (DF1) explained 92.91% of the variance in the original data set, and DF2 and DF3 explained a further 3.74% and 3.35% of the variance, respectively. Reference specimens of *M. putorius* and *M. eversmanni* formed two clearly distinct clusters when the data were projected onto the first

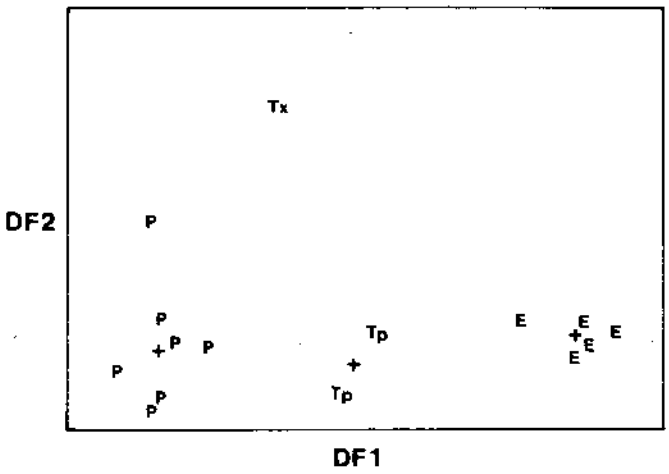

Fig. 2. Projection of four groups of polecats on the first two discriminant functions. Crosses indicate group centroids. P: *M. putorius*, E: *M. eversmanni*, Tp: *M. putorius* from European Turkey, Tx: specimen TUBD 87/100

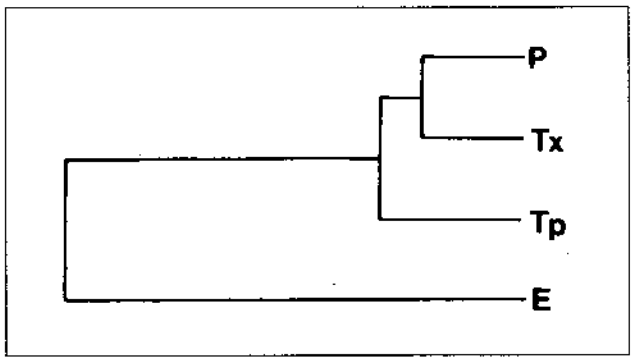

Fig. 3. UPGMA dendrogram summarizing relations between four groups of polecats as indicated in Fig. 2. See text for additional information. Cophentic correlation coefficient r=0.815.

two discriminant functions (Fig. 2). All three Turkish specimens were placed closer to *M. putorius* than to *M. eversmanni*. Next, an Euclidian Distance Matrix was calculated from the group centroid scores of the three discriminant functions and subjected to UPGMA clustering. Turkish polecats clustered with *M. putorius* (Fig. 2), and show no affinities with *M. eversmanni*. This, together with the coat colour indicates, that postorbital constriction alone is not very reliable as a diagnostic character for *M. putorius* in the extreme southern border of the species' distribution range. Of the other diagnostic characters listed by Wolsan (1993), the shape of the pterygoid processes, together with the width of the interpterygoid space, also classified specimen TUBD 87/100 with *M. putorius* (Fig. 1). Consequently, all our specimens from European Turkey have been allocated to *M. putorius*.

Mustela eversmanni was reported recently from Macedonia, the determination being based mainly on the postorbital constriction (Milenkovic, 1990; see also SCC No. 7:16, 1992). Milenkovic's record suggests a considerable shift of *M. eversmanni*'s distribution range towards the south, but this was not considered by Wolsan (1993) in his distribution map for the species. We are of opinion that the determination of this particular record should be reconsidered, taking into consideration the cranial variation observed within Thracian polecats.

The polecat has been recorded from eight localities in European Turkey (Fig. 4). This is a considerable number in comparison with the other south balkan countries. The records derive from all the vegetation zones of European Turkey, but it does seem, that the species is linked closely with human settlements. According to our observations, polecats frequently enter poultry houses, and the majority of our specimens were collected in such places. On the basis of data obtained in 1969 from the major furrier's shops in Istanbul, Kumerloeve (1975) considered the polecat to be fairly common in the Istanca Mts. and the hilly regions of Thrace. Unfortunately, local people from Demirköy do not distinguish between the polecat and the Stone marten (*Martes foina*), and use the name 'sansar' for both taxa. A 1994 inspection of local hunters in this area indicated that all the skins they held belonged to the latter species, thus suggesting that the polecat is not so commonly seen in European Turkey.

According to the 1993-94 Hunting Rules (the 1994-95 Hunting Rules are not yet published) the hunting season for the European polecat in Turkey is from 15 October until the end of February. Hunting is permitted only for three days per week (wednesday, saturday, and sunday), and hunters may take only one animal per day. Other carnivores with the same hunting regime are *Mustela erminea, Mustela nivalis, Martes foina, Martes martes, Vormela peregusna, Meles meles*, and *Vulpes vulpes*.

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We thank Dr Milos Andera (Natl. Museum in Prague) for loan of the skulls of *Mustela eversmanni* and Huw Griffiths (Leeds) for critical comments on an earlier draft and linguistic corrections.

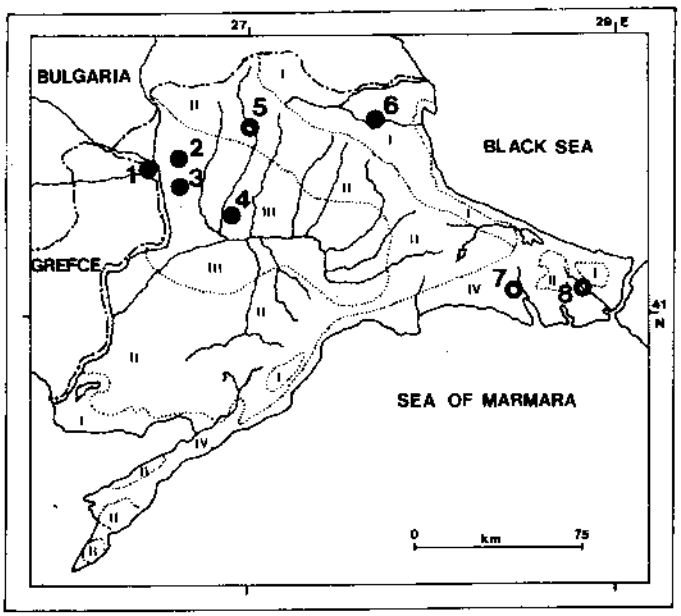

Fig. 4. Geographic distribution of the European polecat, *Mustela putorius*, in European Turkey. Closed circles indicate localities from which material was examined in this study (see text for the acronyms of collections). Vegetation zones: I, humid forests; II, dry forests; III, steppe; IV, maquis and pseudo-maquis. Localities: 1, Edirne, Karaagac (TUBD); 2, Edirne (TUBD); 3, Edirne, Sazlidere (TUBD); 4, Babaeski (TUBD); 5, vicinity of Kirklareli Kumerloeve, 1970); (6, Demirköy (Kumerloeve, 1967; PMS); 7, near Catalca (Kumerloeve, 1967); 8, Belgrade Forest near Istanbul (Dogramaci, 1989)

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Polymorphisms in the European polecat, *Mustela Putorius*, in France

In numerous papers dealing with the wild European polecat, *Mustela putorius* L., the eclecticism of its habitat choice has often been emphasized. Changes in habitat use are mainly influenced by trophic factors (Lodé, 1994) but, throughout Europe, polecats are known to exploit such diverse habitats as forest, woodlands, farmland, marshes, ponds, watercourses, seashores, the Russian steppes, farmbuildings, and rubbish tips (Blanford, 1987). Moreover, polecats exhibit important polymorphisms in body size and hair colour (Kratochvil, 1952; Saint-Girons, 1973).

Of 134 adult polecats collected in France (96 animals killed on the roads and 38 live-trapped), 3.7% (n=5) had a dark facial pattern with no white hair on the face, whilst 40.3% (n=54) only had a dark mask over the eyes, the forehead and the cheeks remaining white (Table 1). In 21.6% (n=29) of the polecats studied, only two light spots of hair were visible on the face above the eyes, and 34.3% had a dark forehead. However, in each case the snout was white coloured, and the underfur varied from yellowish to light brown. Although young polecats have a uniformly dark face when only two months old, the facial pattern can lighten with age, and varies little after four months (Lodé, 1989). Here, the ages of the animals were estimated from examination of the pattern of tooth attrition and from the weight of the baculum (Walton, 1968). No differences were found between males and females ($X^2 = 2.71$, $p>0.05$), but the variation of the facial pattern was also associated with large differences in weight and body size (the darkest individuals being the smallest). Some "dark" animals looked almost like *Mustela lutreola* from their external pattern, and this could lead to some confusion.

Facial Pattern	mask		dark		
	dark stripe only	*dark forehead*	*2 light spots*	*dark face*	*n*
% males	*35.8*	*35.8*	*24.2*	*4.2*	*95*
Mean weight	1,580g	1,560g	1,400g	970g	
% females	*51.3*	*43.6*	*15.4*	*2.6*	*39*
Mean weight	980g	980g	850g	650g	
% total	*40.3*	*34.3*	*21.6*	*3.7*	
Habitats					
- wooded stream	5.8	8.6	31.0	80.0	14.9
- marsh	38.5	56.5	55.2	20.0	47.8
- farmland	56.7	24.8	13.8	0.0	44.8
n =	*54*	*46*	*29*	*5*	*134*

Table 1. Frequency of occurrence of different facial patterns in *Mustela putorius* from France

Furthermore, this polymorphism is related to habitat use. The data available show that "dark" polecats are found significantly more frequently near forest watercourses and wooded ponds ($X^2 = 29.3$, $p<0.001$). This relationship between phenotypic divergence and habitat utilization may represent a new illustration of Gloger's rule in mustelids. (Gloger's rule: Individuals of many species are darkly pigmented in humid climates).

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